

ENVIRONMENTAL PROTECTION AGENCY

[FRL-]

Fuels and Fuel Additives; Waiver Decision

AGENCY: Environmental Protection Agency (EPA)

ACTION: Notice

SUMMARY: Pursuant to section 211(f) of the Clean Air Act (Act), the Administrator of EPA is conditionally granting a waiver for a fuel consisting of a blend of up to 15 percent methyl tertiary butyl ether (MTBE) in unleaded gasoline submitted by the Sun Refining and Marketing Company (Sun).

ADDRESS: Copies of documents relevant to this waiver application, including the Administrator's decision document, are available for inspection in public docket EN-88-02 at the Central Docket Section (LE-131) of the EPA, South Conference Center, Room 4, 401 M Street, S.W., Washington, D.C. 20460, (202)382-7548, between the hours of 8:00 a.m. and 3:00 p.m. As provided in 40 CFR Part 2, a reasonable fee may be charged for copying services.

FOR FURTHER INFORMATION CONTACT: David J. Kortum, Environmental Engineer, Field Operations and Support Division (EN-397F), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460 (202)475-8841.

SUPPLEMENTARY INFORMATION: Section 211(f) (1) of the Act makes it unlawful, effective March 31, 1977, for any manufacturer of a fuel or fuel additive to first introduce into commerce, or to increase the concentration in use of, any fuel or fuel additive for use in light-duty motor vehicles manufactured after model year 1974 which is not substantially similar to any fuel or fuel additive utilized in the certification of any model year 1975 or subsequent model year, vehicle or engine under section 206 of the Act. EPA has defined "substantially similar" at 40 FR 38528 (July 28, 1981).

Section 211(f) (4) of the Act provides that upon application by any fuel or fuel additive manufacturer the Administrator of EPA may waive the prohibition of section 211(f) (1), if the Administrator determines that the applicant has established that such fuel or fuel additive will not cause or contribute to a failure of any emission control device or system (over the useful life of any vehicle in which such device or system is used) to achieve compliance by the vehicle with the emissions standards to which it has been certified pursuant to section 206 of the Act. If the Administrator does not act to grant or deny a waiver within 180 days of receipt of the application (in this case, September 12, 1988), the statute provides that the waiver shall be treated as granted.

Methyl tertiary butyl ether (MTBE) is already permitted in gasoline in volumes up to approximately 11 percent under EPA's substantially similar interpretive rule. Sun Refining and Marketing Company (Sun) has requested that EPA grant a waiver for the introduction into commerce of an ether-gasoline fuel blend containing up to 15 percent MTBE by volume as measured by gas chromatograph or equivalent techniques. The waiver application specifies that the ether-gasoline blend must conform with the requirements of ASTM D-2 Proposal P-176, "Proposed Specification for Automotive Spark Ignition Engine Fuel" (subsequently adopted as ASTM D4814), and the fuel manufacturer must take all reasonable precautions, including identification and description of the product on shipping manifests, to ensure that the finished fuel is not used as a base gasoline to which other oxygenated materials are added, according to EPA limitations and guidelines. The application states that the marketing of the waiver blend would be handled in the same way as current marketing with other MTBE concentrations up to 11 percent.

For reasons specified in the decision document (available as described above), EPA has decided to conditionally grant Sun's request for a waiver. This decision is based on the determination that Sun has demonstrated that the ether-gasoline fuel, when used as specified in the decision document, will not cause or contribute to a failure of 1975 or subsequent model year

vehicles or engines to comply with the emission standards with respect to which such vehicles or engines were certified under section 206 of the Act. Thus, the waiver request is granted provided the following conditions are met:

- (1) The final fuel consists of up to 15 percent by volume MTBE in unleaded gasoline;
- (2) The final fuel must meet ASTM D4814 "Standard Specification for Automotive Spark Ignition Fuel" (a copy of which is in the docket);
- (3) The fuel manufacturer must take all reasonable precautions, including identification and description of the product on shipping manifests, to ensure that the finished fuel is not used as a base gasoline to which other oxygenated materials are added.

EPA has determined that this action does not meet any of the criteria for classification as a major rule under Executive Order 12291. Therefore, no regulatory impact analysis is required.

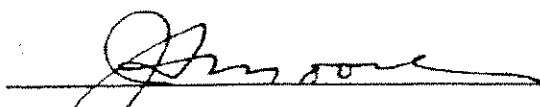
This action is not a "rule" as defined in the Regulatory Flexibility Act, 5 U.S.C. 601 et seq., because EPA has not published, and is not required to publish, a Notice of Proposed Rulemaking under the Administrative

Procedure Act, 5 U.S.C. 553(b), or any other law.

Therefore, EPA has not prepared a supporting regulatory flexibility analysis addressing the impact of this action on small entities.

This is a final Agency action of national applicability. Jurisdiction to review this action lies exclusively in the U.S. Court of Appeals for the District of Columbia Circuit. Under section 307(b)(1) of the Act, judicial review of this action is available only by the filing of a petition for review in the U.S. Court of Appeals for the District of Columbia Circuit within 60 days of [INSERT DATE OF PUBLICATION OF THIS NOTICE]. Under section 307(b)(2) of the Act, today's action may not be challenged later in separate judicial proceeding brought by the Agency to enforce the statutory prohibitions.

Dated: [INSERT DATE OF SIGNATURE]


for Lee M. Thomas,
Administrator

August 5, 1988

ENVIRONMENTAL PROTECTION AGENCY

Conditional Grant of Application for a Fuel Waiver
Submitted by Sun Refining and Marketing Company
Decision of the Administrator

I. Introduction

On March 14, 1988, Sun Refining and Marketing Company (Sun) submitted a waiver application to the Environmental Protection Agency (EPA) under section 211(f)(4) of the Clean Air Act (Act), 42 U.S.C. 7545 (f)(4). 1/ The application requests a waiver for the introduction into commerce of an ether-gasoline fuel blend containing up to 15 percent methyl tertiary butyl ether (MTBE) by volume, as measured by gas chromatograph or equivalent techniques. The waiver application specifies that the ether-gasoline blend must conform with the requirements of the American Society for Testing and Materials (ASTM) D-2 Proposal P-176, "Proposed Specification for Automotive Spark Ignition Engine Fuel", 2/ and that the fuel manufacturer

1/ On April 8, 1988, a notice was published in the Federal Register acknowledging receipt of the application and requesting comments on it. Comments that were received have been placed in public docket EN-88-02.

2/ ASTM P-176 was subsequently adopted by ASTM and is now incorporated in ASTM D4814. See the discussion at page 17, *infra*.

take all reasonable precautions, including identification and description of the product on shipping manifests, to ensure that the finished fuel is not used as a base gasoline to which other oxygenated materials are added, according to EPA limitations and guidelines. The application states that handling situations with the marketing of 15 percent MTBE would be the same as current marketing with other MTBE concentrations at up to 11 percent.

Section 211(f)(1) of the Clean Air Act makes it unlawful, effective March 31, 1977, for any manufacturer of a fuel or fuel additive to first introduce into commerce, or to increase the concentration in use of, any fuel or fuel additive for use in light duty motor vehicles manufactured after model year 1974 which is not substantially similar to any fuel or fuel additive utilized in the certification of any model year 1975, or subsequent model year, vehicle or engine under section 206 of the Act.^{3/} Section 211(f)(4) of the Act provides that upon application by any fuel or fuel additive manufacturer the Administrator of EPA may waive the prohibition of section 211(f)(1) if the Administrator determines that the applicant has established that such fuel or fuel additive

^{3/} Section 206 of the Act sets forth the certification requirements with which vehicle manufacturers must comply in order to introduce into commerce new model-year motor vehicles.

will not cause or contribute to a failure of any emission control device or system (over the useful life of any vehicle in which such device or system is used) to achieve compliance by the vehicle with the emissions standards ^{4/} to which it has been certified pursuant to section 206 of the Act. If the Administrator does not act to grant or deny a waiver within 180 days of receipt of the application (in this case by September 12, 1988), the statute provides that the waiver shall be treated as granted.

Since 15 percent by volume MTBE exceeds the limit allowed under the "substantially similar" rule,^{5/} Sun has applied for a waiver under section 211(f)(4), in support of which Sun has submitted data and analyses covering the areas of exhaust emissions, evaporative emissions, materials compatibility, and driveability. Sun contends that its waiver application demonstrates that its fuel, used within the maximum limits requested, would not cause or contribute to a failure of any emission control device

^{4/} Standards for hydrocarbon, carbon monoxide, and oxides of nitrogen emissions from gasoline-powered vehicles have been established under section 202 of the Act .

^{5/} EPA's revised interpretation of "substantially similar" was published in the Federal Register on July 28, 1981 at 46 FR 38582. Under this rule, aliphatic ethers, such as MTBE, are allowable, provided the final fuel contains no more than 2 percent oxygen by weight. In a typical gasoline, 11 percent MTBE by volume would contribute the maximum allowable oxygen.

or system (over the useful life of any vehicle in which such device or system is used) to achieve compliance by the vehicle with the emission standards with respect to which it has been certified pursuant to section 20 of the Act.

II. Summary of Decision

EPA has determined that Sun has met the burden established under section 211(f)(4) of the Act, provided the production of the ether-gasoline fuel is done in accordance with the requirements stipulated in this decision. In reaching this decision, EPA has considered all the available information and data, including comments submitted pursuant to the April 8, 1988, Federal Register notice.

III. Summary of Comments

Comments were received from eleven parties, including one Arizona State House Member, three trade associations, one special interest group, three automobile manufacturers, and three gasoline manufacturers. Of these eleven commenters, only one, Toyota Technical Center, U.S.A., Inc. (Toyota), requested that EPA deny the waiver application. (Those concerns of Toyota which require more detailed discussion are addressed later in this document.) Mr. Jack Jewett, an Arizona State Representative, strongly urged approval of the waiver request. Chrysler Motors Corporation and Ford Motor Company stated that they had no serious objections to granting the waiver. Texaco, Inc., Mobil Oil Corporation (Mobil), and ARCO Chemical Company (ARCO) supported granting the waiver. However, Mobil and ARCO expressed reservations about some of the conditions in the waiver application. (These reservations are addressed later in this document.) Although the International Society for VEHICLE Preservation commented on the use of MTBE, it indicated no specific recommendation for approval or denial of this waiver application. The Oxygenated Fuels Association and the American Petroleum Institute (API) expressed support for the waiver. However, API expressed reservations about some of the conditions in the application similar to those expressed by Mobil and ARCO. The Renewable Fuels Association (RFA) stated that it was generally supportive of the application. However, it

pointed out that a grant of the application would likely further increase the use of MTBE and further limit the availability of MTBE-free gasoline for ethanol blending. RFA also raised the issue of health effects testing of MTBE, which is addressed later in this document.

IV. Method of Review

In order to obtain a waiver for a fuel or fuel additive (fuel or fuel additive will be collectively referred to as "fuel"), section 211(f)(4) of the Act requires that the applicant establish that the fuel and its emission products will not cause or contribute to a failure of any emission control device or system (over the useful life of any vehicle in which such device or system is used) to achieve compliance by the vehicle with the emission standards under which it has been certified. If interpreted literally, this burden of proof imposed by the Act would be virtually impossible for an applicant to meet, as it requires the proof of a negative proposition, i.e., that no vehicle will fail to meet emission standards to which it has been certified. Taken literally, it would require the testing of every vehicle. Recognizing that Congress contemplated a workable waiver provision, EPA has previously indicated that reliable statistical sampling and fleet testing protocols may be used to demonstrate that a fuel under consideration would not cause or contribute to a significant failure to meet emission standards by vehicles in the national fleet. (See Waiver Decision on Tertiary Butyl Alcohol ("TBA"), 44 FR 10530 (February 2, 1979).)

To determine whether a waiver application demonstrates that the proposed fuel meets this standard, EPA reviews all the material in the public docket, including the data submitted with the application, and analyzes the data to

ascertain the fuel's emission effects. The analysis concentrates on four major areas of concern: exhaust emissions, evaporative emissions, materials compatibility, and driveability -- and evaluates the data using statistical methods appropriate to the various types of emission effects.

Exhaust emission data are analyzed according to the effects that a fuel is predicted to have on emissions over time. If the fuel is predicted to have only an instantaneous effect on emissions (i.e., the emission effects of the fuel remain constant throughout the useful life of the vehicle), then "back-to-back" emission testing will suffice.^{6/} Back-to-back testing data are analyzed using three statistical tests which are described later in this decision. If the fuel is predicted to have a long-term deteriorative effect, however, then 50,000-mile

^{6/} Back-to-back emission testing involves testing a vehicle on a base fuel (i.e., a gasoline which meets specifications for certification fuel or is representative of a typically available commercial gasoline), then testing that same vehicle on the fuel for which the waiver is requested. The difference in exhaust emission levels is attributed to the waiver fuel.

durability testing, in addition to back-to-back testing, may be appropriate.^{2/}

Reasonable theoretical judgments as to the emission effects of the fuel may be utilized as an alternative to direct testing of vehicles. In most cases, the theory needs to be supported by confirmatory testing. (See Waiver Decision on Application of E.I. DuPont de Nemours and Company (DuPont), 48 FR 8124 (February 25, 1983).) If the applicant has such a theoretical basis, he may only need to conduct an amount of testing sufficient to demonstrate the validity of the theory. The theory and confirmatory testing may then form a basis from which the Administrator may exercise his judgment on whether the additive will cause or contribute to a significant failure of emission control devices or systems which result in a failure by vehicles to achieve compliance with emission standards. In addition to emission data, EPA also reviews data on fuel composition and specifications, both to fully characterize a proposed fuel, and to determine whether that fuel would cause or contribute to a failure of vehicles to comply with their emission standards. Such failure often can be predicted from characterization data. For example,

^{2/} Fifty-thousand mile durability testing involves testing two identical sets of vehicles for 50,000 miles, one set using the base fuel and the other using the waiver fuel. Each vehicle is tested for emissions at 5,000 mile intervals. This is essentially the same testing pattern which is required for certification of a new motor vehicle under section 206 of the Act.

volatility specifications of the fuel could demonstrate a tendency for high evaporative emissions. Similarly, data on materials compatibility could show potential failure of fuel systems, emission related parts, and emission control parts from use of the fuel. Such failures could result in greater emissions. Likewise, fuel characteristics that could cause significant driveability problems could result in tampering with emission controls and, thus, increased emissions.

V. Analysis

Sun developed and referenced technical data to demonstrate that gasoline-MTBE fuel blends covered by the waiver application will not cause or contribute to a failure to meet emission control standards by vehicles in the national fleet. Data were developed by Sun in the areas of exhaust emissions, evaporative emissions, vehicle driveability, and materials compatibility.

A. Exhaust Emission Data

In support of its waiver application, Sun performed back-to-back exhaust emissions tests on eight vehicles utilizing Indolene (control fuel) and Indolene containing 15 percent by volume MTBE (test fuel). Each of the emissions tests was conducted in duplicate.

EPA employs three statistical tests to analyze exhaust emissions results obtained by fuel manufacturers in testing any waived fuel. The three tests are: the Paired Difference Test, the Sign of the Difference Test, and the Deteriorated Emissions Test (a full description of the three tests is contained in Appendix A). EPA analyzed the test data submitted by Sun using these three statistical criteria and the results are discussed in Appendix B. The exhaust emissions tests indicate that the waiver fuel does not cause or contribute to the failure of vehicles to meet exhaust emission standards.

Although the Agency is unaware of any long-term deteriorative effects on exhaust emissions associated with oxygenates, Sun also performed 50,000-mile durability testing using two vehicles, one operating on Indolene, the other on Indolene and 15 percent (by volume) MTBE. A sample consisting of one vehicle operating on each fuel is too small to justify any statistical conclusions concerning the relative performance of the control and test fuels. However, the data indicate that the vehicle operating on the MTBE fuel experienced no more exhaust emissions deterioration than the vehicle operating on the control fuel.

In its comments, the Toyota Technical Center, U.S.A., Inc. (Toyota) presented data indicating that the use of 15 percent MTBE deteriorated the conversion efficiency of the catalyst of a 1980 Japanese vehicle tested under "normal operation on Japanese public roads." Although the details of the test program were not provided, the data collected by Toyota are contrary to the results provided by Sun. Toyota also cites a report on methanol-blended fuel ("Chrysler Results of the Joint Chrysler/Arco Cooperative Test Agreement on Alcohol/Gasoline Blends") which indicated increased deterioration of exhaust emissions when utilizing methanol blends. Toyota's main conclusion is that the durability data provided by Sun are inadequate due to the low number of tests performed, to overcome Toyota's concern about potential long-term deteriorative effects.

As previously pointed out in this decision, the testing performed by Sun did not include a large enough sample to be statistically definitive. However, the Agency is aware of no mechanism by which oxygenates could poison catalysts or otherwise cause catalyst efficiency to decrease over time. Furthermore, the Chrysler/Arco Report cited by Toyota dealt with the effects of methanol blends and not MTBE. The vast majority of data indicate that the effect of oxygenates on exhaust emissions is instantaneous, and, in past waiver decisions involving oxygenates, deterioration of exhaust emissions over time has not been a significant issue. Moreover, no other commenters, including other automotive companies, expressed a concern with increased deterioration of the catalyst or other emission controls associated with the use of MTBE. Thus, the Agency concludes that the Sun MTBE blend is not likely to cause long-term emissions deterioration and that durability testing is not required.

Furthermore, based on Sun's back-to-back testing, the Agency concludes that, with respect to instantaneous exhaust emissions, the waiver fuel will not cause the failure of vehicles to meet their emissions standards. These results are consistent with data which have been reported under many other testing programs and with the conclusions of EPA's January, 1988 document, "Guidance on Estimating Motor Vehicle Emission Reductions From the Use of Alternative Fuels and Fuel Blends" (the Guidance

Document), a copy of which is in the docket. Therefore, the Agency concludes that this ether-gasoline fuel does not cause or contribute to the failure of vehicles to meet applicable exhaust emission standards.

B. Evaporative Emission Data

In support of its waiver application, Sun performed back-to-back sealed housing for evaporative determination (SHED) tests on eight vehicles utilizing the test and control fuels described above. EPA analyzed the test data submitted by Sun using the three statistical tests (referred to above) and the results are discussed in Appendix B. The SHED data indicate that no statistically significant increase in evaporative emissions occurred due to the addition of 15 percent by volume MTBE.

As with exhaust emissions, Sun performed limited 50,000-mile durability testing for evaporative emissions. Although the sample of vehicles is too small to reach a statistically significant conclusion, the data indicate that the vehicle operating on a fuel blend containing 15 percent by volume MTBE experienced no more evaporative emissions degradation than the vehicle operating on the control fuel.

Sun also submitted the results of a bench study investigating the effect of various hydrocarbon gasolines and gasoline-MTBE blends on the working capacity of evaporative emission control cannisters. That study

concluded that the various fuels tested had little effect on the working capacity of the cannister charcoal, with one exception. The 15 percent by volume MTBE blend had an "appreciable" positive effect on working capacity.

Recently, EPA's Motor Vehicle Emissions Laboratory tested late model in-use vehicles with an 15 percent by volume MTBE blend as well as a 10 percent by volume ethanol blend and a commercial gasoline. All three fuels were intended to be blended so as to have the same Reid Vapor Pressure (RVP). The results of this study appeared to indicate higher evaporative emissions for the MTBE blend than for the commercial gasoline or the ethanol blend. (See the June 7, 1988 EPA memo from Phil Loring to Barry Nussbaum, in the docket.) However, upon analysis of the fuels used in this study, EPA found that the RVP's of these fuels were not as closely matched as was originally intended, and, in fact, the MTBE blend had a higher RVP than the other fuels. (See the July 21, 1988 EPA memo from Phil Loring to Barry Nussbaum, in the docket.) The Agency has concluded that the higher RVP of the MTBE blend was sufficient to account for the increase in evaporative emissions compared to the other fuels.

In previous waivers involving oxygenated fuels the Agency has relied on adherence to ASTM D439 volatility specifications (which have now been incorporated into the new standard, ASTM D4814 "Standard Specification for Automotive Spark-Ignition Fuel") in order to control

evaporative emissions. (See the DuPont Waiver Reconsideration at 51 FR 39802, October 31, 1986.) Under this standard, gasoline is divided into five volatility classes (A through E) in which the primary volatility parameter controlled is RVP, according to the geographic area and time of year in which the gasoline is to be used.

In its January 10, 1985 DuPont decision (50 FR 2615), the Agency concluded that in order for DuPont to establish that its fuel blend would not cause or contribute to a failure of any emission control device or system to achieve compliance by the vehicle with the evaporative emission standards, the average volatility of the waiver blend would have to be equal to the average volatility of the gasoline it displaced from the market for those volatility parameters which determine vapor generation and evaporative emissions. In its October 31, 1986 reconsideration of the DuPont waiver (51 FR 39802), the Agency concluded that ASTM standards would place sufficient limitation on the DuPont blend so that the evaporative emissions of vehicles using this blend would remain approximately the same as those of vehicles using gasoline. The Agency believes that the same conclusion holds for the Sun fuel. As previously mentioned, such restrictions were proposed by Sun in the waiver application.

Therefore, EPA concludes that the ether-gasoline blend which is the subject of this waiver will not cause or contribute to the failure of vehicles to meet evaporative

emission standards provided it is blended to meet ASTM D4814 "Standard Specification for Automotive Spark-Ignition Fuel" specifications as well as the other waiver specifications.

It should be noted, however, that the Agency has proposed uniform volatility limitations under section 211(c) of the Act (52 FR 31274, August 19, 1987) which may result in volatility controls on all fuel types, including those which have been granted waivers under section 211(f)(4).

C. Materials Compatibility

Materials compatibility is an important factor when reviewing a waiver request. Materials incompatibility can contribute to or cause the failure of vehicles to meet either their exhaust or evaporative emission standards. This can occur because a fuel or additive may cause changes in the components in carburetors or fuel systems which exceed the tolerances specified by the manufacturer. Such changes can impair the performance of the vehicle to the point that emissions are adversely affected.

Sun performed laboratory evaluations of materials effects of its additive. A variety of automotive metals, plastics, and elastomers was subjected to immersion in hydrocarbon fuels and various MTBE blends in order to simulate compatibility and long term durability effects on vehicle emissions. The six test fuels included:

- (1) a gasoline with 44.5 percent aromatics,
- (2) gasoline (1) plus 11 percent MTBE,
- (3) gasoline (1) plus 15 percent MTBE,
- (4) gasoline (1) plus 7.5 percent MTBE and 5 percent ethanol,
- (5) a gasoline with 50 percent aromatics, and
- (6) gasoline (5) plus 15 percent MTBE.

The results of the tests indicate that only the Viton elastomers experienced higher swell with MTBE blends than non-MTBE blends. Viton elastomers immersed in the 44.5 percent aromatic base fuel with 15 percent MTBE exhibited volumetric swell around 7 percent compared to swell around 4 percent for this base gasoline alone. Additionally, the 50 percent aromatic base gasoline produced swell in one of two Viton elastomers of around 7 percent without MTBE and around 11 percent with 15 percent by volume MTBE.

In its comments, Toyota presented data supporting the contention that the swell of Viton elastomers increases with increasing MTBE concentrations. The data submitted by Toyota indicate swelling similar in magnitude to that reported by Sun for fluorinated elastomers like Viton (i.e., approximately 7 percent swell at an MTBE concentration of 15 percent). Toyota comments that "Sun's estimate that a 7% swell level would not cause any problems is very optimistic."

The Agency concludes that the presence of up to 15 percent MTBE can result in some swelling in Viton elastomers beyond what would be experienced in fuels without MTBE. However, the increase is relatively small and was not an issue of concern with any other automaker. In reviewing the literature, the Agency attempted to determine a level of swell which would cause concern, and found no generally acceptable limit. However, Abu-Isa 8/ of General Motors Research Laboratories, who has conducted extensive research in this area, suggests that an elastomer which does not exceed a level of swell of 30 percent be considered a fuel resistant elastomer. Thirty percent swell is well above the maximum levels of swell associated with use of the waiver fuel as reported by Sun. Furthermore, Sun performed extended mileage accumulation testing on four automobiles operating on fuel containing 15 percent MTBE. These vehicles experienced no fuel related maintenance problems such as might be experienced if excess swell occurred. Thus, EPA sees no basis for disagreeing with Sun's conclusion that Viton elastomer swells of the magnitude observed in the 15 percent MTBE tests, will not cause or contribute to vehicles failing to meet emission standards.

8/ "Elastomer-Gasoline blends Interactions I. Effects of Methanol-Gasoline Mixtures on Elastomers," Ismat A. Abu-Isa, Rubber Chemistry and Technology, 56:169 (1983).

Sun also examined the mileage accumulation vehicles for signs of metal corrosion. No visible signs of corrosion in the fuel delivery systems were evident. On one of the vehicles, the fuel tank was removed and inspected and it showed "no excessive corrosion," according to the Sun application.

Therefore, based on the information submitted by Sun and other data previously reported, EPA concludes that the waiver additive does not present a materials compatibility problem affecting emissions with the fuel systems currently in use.

D. Driveability

Sun contends in its waiver application that, since other oxygenate fuel blends at a 3.7 percent by weight oxygen have been widely accepted by the public, a 15 percent by volume MTBE fuel blend having a concentration of approximately 2.7 percent by weight oxygen would be expected to be equivalent in driveability to an all hydrocarbon gasoline.

Nevertheless, Sun performed driveability testing on eight cars using six fuels: two all hydrocarbon gasolines (one having high volatility, one having low volatility), two 11 percent by volume MTBE blends (using the two hydrocarbon gasolines as base stocks), and two 15 percent by volume MTBE blends (also using the two hydrocarbon gasolines as base stocks). The results of the testing

indicated no significant differences in driveability for the six fuels.

At the suggestion of automobile manufacturers, Sun also studied fuel injector plugging on six cars, four of which were tested for 35,000 miles utilizing a Sun fuel containing 15 percent by volume MTBE, and two matched vehicles tested for 50,000 miles, one operating on a base all hydrocarbon fuel and one operating on the same base fuel with 15 percent by volume MTBE. The degree of plugging exhibited no pattern. Sun also performed driveability tests on the vehicles before and after the injectors were replaced and the testing showed no significant pattern of improvement in driveability for the test fuel cars or for the base fuel car after replacement. These data, therefore, indicate that the waiver fuel does not cause increased fuel injector plugging.

Previous studies conducted by others have shown that driveability is a function of fuel oxygen content, and gasoline-alcohol fuels which contain no more than 3.7 percent by weight fuel oxygen have only minimal effects on driveability. EPA therefore, concludes that driveability for fuels containing 15 percent by volume MTBE would also cause no significant problems. Furthermore, the Agency is aware of no information that would tend to contradict the conclusions of Sun's driveability and fuel injector studies.

E. Oxygen Content

Because of the oxygen content permitted under this waiver, EPA is concerned that this fuel not be a base fuel to which additional oxygenated components might be added. The waiver application states, and EPA is requiring, that the fuel manufacturer take all reasonable precautions to ensure that once its ether-gasoline blend is a final fuel, such final fuel is not used as a base gasoline to which other oxygenated additives are added.

F. Health Effects Testing

EPA has signed an enforceable Testing Consent Order with five MTBE manufacturers under the Toxic Substances Control Act (TSCA). (See 53 FR 10391, March 1, 1988.) These manufacturers have agreed to perform certain health effects tests for MTBE. In its comments on the fuel waiver application, the Renewable Fuels Association (RFA) contends that the testing being performed under TSCA presents a "dilemma of sorts for EPA" since the Agency is simultaneously making a decision concerning the use of MTBE under the Clean Air Act.

There are no inconsistencies between the ongoing investigation of MTBE health effects under TSCA and the decision on whether to grant a fuel waiver for use of MTBE using the criteria specified by the Clean Air Act. The Agency will continue to closely monitor the results of the

health effects testing currently being performed as prescribed in the Testing Consent Order and will exercise its option to regulate MTBE under TSCA or section 211 of the Clean Air Act if the results of these studies indicate such action is needed.

G. Gas Chromatography Analysis

Sun defines its waiver request as a "maximum of 15 volume percent MTBE...as measured by Gas Chromatograph or equivalent techniques." Two commenters, ARCO Chemical Company and the American Petroleum Institute (API), pointed out that the language of the Sun application could be interpreted to mean that a gas chromatography analysis of MTBE content would be required with each MTBE addition covered by the waiver. API and Mobil Oil further state that metering is more accurate than current analytical techniques such as gas chromatography. The Agency agrees that gas chromatography analysis is not the only measurement technique by which a fuel manufacturer can achieve compliance with the 15 percent by volume MTBE restriction imposed by the waiver. Therefore, as with previously granted waivers, a specific method of measurement is not specified.

VI. Findings and Conclusions

EPA has determined that, subject to the conditions below, Sun has established that an ether-gasoline blend produced with 15 percent by volume MTBE will not cause or contribute to a failure of emission control devices or systems (over the useful life of vehicles in which such devices or systems are used) to achieve compliance by the vehicles with the emission standards with respect to which they have been certified pursuant to section 6 of the Act.

The waiver requested by Sun for its ether gasoline blend is hereby granted, provided the following conditions are met:

- (1) The final fuel consists of up to 15 percent by volume MTBE in unleaded gasoline;
- (2) The final fuel must meet ASTM D4814 "Standard Specification for Automotive Spark Ignition Fuel" (a copy of which is in the docket);
- (3) The fuel manufacturer must take all reasonable precautions, including identification and description

of the product on shipping manifests, to ensure that the finished fuel is not used as a base gasoline to which other oxygenated materials are added.

25 Aug 88

Date

Atty Deputy

Administrator

APPENDIX A

STATISTICAL CRITERIA

The following is a brief description of the statistical tests used to characterize the emission effects of a fuel or fuel additive:

(1) The Paired Difference Test

For each vehicle tested on a base fuel and on the waiver fuel or fuel additive, the difference between the waiver fuel or fuel additive emissions and the base fuel emissions is calculated. A 90 percent confidence interval is constructed for the mean difference. If the resulting interval lies entirely below zero, it is indicative of no adverse effect from this waiver fuel or fuel additive. If the entire interval is above zero, it is indicative of an adverse effect from the waiver fuel or fuel additive. If the interval contains zero, there is arguably no difference between the base fuel and the waiver fuel or fuel additive with regard to emissions, provided the confidence interval is small.

(2) The Sign of Difference Test

For each vehicle tested with a base fuel and the waiver fuel or fuel additive, the sign of the emission difference between the waiver fuel or fuel additive emissions and the base fuel emissions is ascertained. This test is designed to determine whether the number of vehicles demonstrating an increase (+) in emissions with the waiver fuel or fuel additive significantly (at least 90 percent confidence level) exceeded those showing a decrease (-) in emissions with the waiver fuel or fuel additive.

(3) The Deteriorated Emissions Test

For each vehicle the effect the waiver fuel or fuel additive has on emissions is determined. This incremental effect, either positive or negative, is added to the 50,000-mile certification emission value of the certification vehicle which the test vehicle represented. This incremented 50,000-mile emission value is compared to emissions standards to determine if it did or did not exceed the standards. Either a pass or fail is assigned accordingly. The pass/fail results are analyzed using a one-sided sign test. The test was designed such that the risk of failing would be at least 90 percent if 25 percent or more of the vehicle population that is represented in the test failed to meet Federal Emissions Standards while operated on the test fuel. For example, for a sample of

eight test vehicles, all eight of these test vehicles must pass in order that the deteriorated emissions test be passed.

The first two methods of analysis are designed to determine whether the waiver fuel or fuel additive has an adverse effect on emissions as compared to the base fuel. Each characterizes a different aspect of adverse effect. The Paired Difference Test determines the mean difference in emissions between the base fuel and the waiver fuel or fuel additive. The Sign of the Difference Test assesses the number of vehicles indicating an increase or decrease in emissions. The two tests are considered together in evaluating whether an adverse effect exists to assure that a mean difference determination is not unduly influenced by very high or very low emission results from only a few vehicles.

The Deteriorated Emissions Test analysis indicates whether the fuel or fuel additive causes a vehicle to fail to meet emission standards. This test examines each vehicle's performance as compared to each pollutant standard. It is useful to perform this analysis even if the first two analyses indicate the waiver fuel or fuel additive has no adverse effect. The analysis indicates whether the emissions from any particular type of vehicles or special emission control technologies are uniquely sensitive to the waiver fuel or fuel additive thus causing vehicles to fail to meet emission standards. This effect could be masked in the previous analyses which consider the emissions results as a group without distinguishing the emissions impact on subgroups.

APPENDIX B

STATISTICAL ANALYSIS OF DATA SUBMITTED BY SUN IN SUPPORT OF 15 PERCENT MTBE FUEL WAIVER REQUEST

The data set that is examined here is comprised of tests performed on eight light duty vehicles of model year 1985 or later and were submitted with Sun's waiver application for 15 percent MTBE. Data were gathered on unburned hydrocarbons, carbon monoxide, oxides of nitrogen, and evaporative hydrocarbons in back-to-back test pairs conducted, respectively, on a control fuel and on the fuel for which a waiver is being sought.

The average change in emissions from control fuel to test fuel in the sample data is a decrease for all four pollutants. Vehicles showing a decrease outnumber vehicles showing an increase in all cases. Tailpipe hydrocarbons showed an average decrease of 6.1 percent; carbon monoxide decreased on average by 10.6 percent; oxides of nitrogen decreased by 7.7 percent; and evaporative emissions fell, on average, by 3.4 percent.

In the remainder of this discussion the three statistical tests discussed in Appendix A are applied to the data for each of the pollutants.

#1 -- Paired Difference Test

Tailpipe hydrocarbons. For hydrocarbons the confidence interval comprising the test is from -0.03 to 0.00. The interval contains zero and is sufficiently small to permit a conclusion that no difference between base and test fuels can be detected from these data.

Carbon monoxide. The interval for carbon monoxide lies entirely below zero (-0.24 to -0.09), leading to the conclusion that use of the test fuel results in decreased carbon monoxide emissions.

Oxides of nitrogen. For this pollutant the confidence interval contains zero and the interval is sufficiently small (-0.10 to 0.02) to permit a conclusion that no differences can be detected from these data.

Evaporative hydrocarbons. The interval for evaporative hydrocarbons includes zero (-0.10 to 0.03) and the interval is small enough to allow us to draw a conclusion--that no differences between base and test fuels' emission results can be identified from this sample.

Test #2 -- Sign of the Difference Test

Tailpipe hydrocarbons. Five of these vehicles showed decreases with the test fuel, two showed increases, and in one case there was no detectable difference. Since the confidence that an increase occurs is very low (6.3 percent), there is no evidence in these data that the test fuel causes emissions increases.

Carbon monoxide. CO decreased from base to test fuel with every vehicle in the test program, resulting in 0.0 percent confidence that an increase occurs.

Oxides of nitrogen. Five of the vehicles showed decreases, while only three increased. It may thus be concluded that there is only a 14.4 percent confidence that an increase occurs.

Evaporative hydrocarbons. The result for this pollutant is the same as that for NOx -- five decreases and three increases, resulting in only 14.4 percent confidence in the occurrence of an increase.

Test #3 -- Deteriorated Emissions Test

Tailpipe hydrocarbons. All eight of the vehicles pass this test for HC emissions. The test fuel thus passes the deteriorated emissions test.

Carbon monoxide. All eight of the vehicles pass this test for CO, and the test fuel passes the test for this pollutant.

Oxides of nitrogen. All eight of the vehicles pass this test for NOx. The test fuel passes the deteriorated emissions test for NOx.

Evaporative hydrocarbons. All eight vehicles pass the test for evaporative hydrocarbon emissions. The test fuel passes the deteriorated emissions test for evaporative hydrocarbons.

None of the individual vehicles in this data set failed this test for any of the four pollutants. We thus conclude that the evidence contained in this data set does not indicate a high probability that a fourth or more of the fleet would exceed standards when using the test fuel.

Summary and Conclusions

When compared with the base fuel used in these tests, the test fuel does not produce emissions increases that result in failure of any of our statistical tests for any of the four pollutants evaluated.